



C/007/016 Incoming

#5016

Chris D. Hansen  
Dir. Of Regulatory Compliance  
225 North 5<sup>th</sup> Street, Suite 900  
Grand Junction, CO 81501  
(970) 261-1425  
Fax (970) 263-5161

October 8, 2015

RECEIVED

OCT 09 2015

DIV. OF OIL, GAS & MINING

Mr. Daron R. Haddock, Coal Environmental Manager  
Division of Oil, Gas, and Mining  
P.O. Box 145801  
Salt Lake City, Utah 84114-5801

RE: Repair Designs for the Lower Section of Reclamation Channel SD-6,  
Gordon Creek 2, 7, and 8 Mines, Permit # C/007/0016

Dear Mr. Haddock:

Please find enclosed with this letter completed copies of C1 and C2 forms and four clean copies of an addendum to Appendix 7-1 that is titled "Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mines, Carbon County, Utah." This addendum includes new designs for the lower section of the SD-6 channel that eroded following a storm that occurred in September 2015. The erosion also occurred following significant repairs to several reclamation drainages at the site, including SD-6, following an apparent greater-than-designed storm that occurred in the Fall of 2015. The redesign includes a modification to the filter material that underlies the channel riprap. Though not shown on the designs and not needed for the channel to function as required, we intend to place some large rocks/small boulders in the foundation at the break in slope of the channel beneath filter material. We believe that placing these larger rocks will impede any erosion that might occur in the future if or when a greater-than-design precipitation event happens.

I appreciate your consideration in this matter. Upon approval of the redesign of the channel, we will complete repairs. We intend the repairs to be completed by November 15, 2015. If you have any questions regarding the information provided in this letter, please give me a call at (970) 261-1425.

Sincerely,

Director of Regulatory Compliance  
Bowie Resource Partners, LLC

# APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC

Mine: Gordon Creek 2, 7 & 8 Mines

Permit Number: C/007/0016

Title: Reclamation Channel SD-6 Repair

Description, Include reason for application and timing required to implement:

Redesign and repair of lower section of reclamation channel SD-6.

**Instructions:** If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

- ☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: \_\_\_\_\_ Disturbed Area: \_\_\_\_\_ ☐ increase ☐ decrease.
- ☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# \_\_\_\_\_
- ☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
- ☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
- ☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
- ☐ Yes ☒ No 6. Does the application require or include public notice publication?
- ☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
- ☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
- ☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # \_\_\_\_\_
- ☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
- Explain: \_\_\_\_\_
- ☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
- ☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
- ☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
- ☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
- ☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
- ☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
- ☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
- ☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
- ☐ Yes ☒ No 19. Does the application require or include certified designs, maps or calculation?
- ☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
- ☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
- ☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
- ☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations herein.

Chris D. Hausen  
Print Name

Chris D. Hausen Dir. Regulatory Compliance  
Sign Name, Position, Date 10-8-15

Subscribed and sworn to before me this 8th day of Oct, 2015

Kathleen Atwood  
Notary Public

My commission Expires: 12-02-2015 } ss:  
Attest: State of Utah }  
County of Carbon



For Office Use Only:

Assigned Tracking  
Number:

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# APPLICATION FOR COAL PERMIT PROCESSING

## Detailed Schedule Of Changes to the Mining And Reclamation Plan

**Permittee:** Canyon Fuel Company, LLC

**Mine:** Gordon Creek 2, 7 & 8 Mines

Permit Number: C/007/0016

**Title:** Reclamation Channel SD-6 Repair

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

## DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED

[illegible]

**Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.**

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## **NOTE**

An Addendum to Appendix 7-1 is located at the end of this appendix and is titled "Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mines, Carbon County, Utah"

This addendum to Appendix 7-1 is intended to be read as an addition to the original designs to reclamation channel SD-6. This redesign is specific to the lower section of SD-6 where erosion of the channel has occurred on two occasions, once following an apparent greater-than-design storm event in the fall of 2014 and a second event that occurred after repairs were completed in the summer of 2015. This redesign is not intended to be implemented at any other reclamation channel at the Gordon Creek Mines.

### Addendum to Appendix 7-1

#### Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mines, Carbon County, Utah

This addendum to Appendix 7-1 is intended to be read as an addition to the original designs to reclamation channel SD-6. This redesign is specific to the lower section of SD-6 where erosion of the channel has occurred on two occasions, once following an apparent greater-than-design storm event in the fall of 2014 and a second event that occurred after repairs were completed in the summer of 2015. This redesign is not intended to be implemented at any other reclamation channel at the Gordon Creek Mines.

# **Revised Plan for Repair of Reclamation Channel SD-6 at the Gordon Creek 2, 7, 8 Mine, Carbon County, Utah**

**Bowie Resource Partners, LLC**  
Grand Junction, Colorado

October 2015



**EarthFax EarthFax Engineering Group, LLC**

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Engineers / Scientists  
[www.earthfax.com](http://www.earthfax.com)

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**REVISED PLAN FOR REPAIR OF  
RECLAMATION CHANNEL SD-6 AT THE  
GORDON CREEK 2,7,8 MINE,  
CARBON COUNTY, UTAH**

**1.0 BACKGROUND**

Reclamation channel SD-6 was designed to convey a peak flow of 7.08 cfs resulting from a 100-year, 6-hour precipitation event. The cross section of the trapezoidal channel (with a 5-foot bottom width, 2H:1V side slopes, and a depth of 1.5 feet) was based on the minimum design channel slope of 7.5%, while riprap sizing was determined based on a maximum design slope of 40%. Riprap sizing was calculated using the permissible velocity approach presented in the 1967 edition of Hydraulic Engineering Circular No. 11 (Searcy, 1967).

A high-intensity precipitation event in September 2014 caused substantial erosion of channel SD-6 and other reclamation channels at the Gordon Creek 2,7,8 Mine in Carbon County, Utah. As a result, these channels were reconstructed to their original design. Another high-intensity event in the summer of 2015 resulted in erosion of the riprap lining in the downstream (steeper) section of channel SD-6. The upper section of channel SD-6, with a milder slope, was not damaged by the recent event. Photographs of the 2015 erosion are provided in Attachment A. As a result of the most recent erosion, the decision was made to re-evaluate the original design approach prior to repairing the channel.

**2.0 DESIGN RE-EVALUATION**

The design of channel SD-6 riprap armoring was re-evaluated using the tractive-force approach recommended in the updated Hydraulic Engineering Circular No. 11 (Brown and Clyde, 1989). According to this method, the median diameter of riprap required to be stable in a channel is calculated using the following equation:

$$D_{50} = 0.001 \frac{V_a^3}{d_{avg}^{0.5} K_1^{1.5}}$$

where

$D_{50}$  = median riprap particle size (ft)

$V_a$  = average flow velocity (ft/s)

$d_{avg}$  = average flow depth (ft)

$K_1$  is defined as:

$$K_1 = [1 - (\sin^2 \theta / \sin^2 \phi)]^{0.5}$$

where

$\theta$  = bank angle with the horizontal

$\phi$  = riprap material angle of repose

The average flow velocity and depth of flow were determined using FlowMaster, based on a design flow of 7.08 cfs and an as-built maximum slope of 44%. A Manning's roughness coefficient of 0.042 was assumed for these calculations based on an assumed median diameter of 18 inches and the following equation developed by Anderson et al. (1970):

$$n = 0.0395 D_{50}^{1/6}$$

where

n = Manning's roughness coefficient

D<sub>50</sub> = median riprap diameter (ft)

These results of these calculations are presented in Attachment B. As indicated, the average velocity in the lower section of reclamation channel SD-6 was calculated to be 7.18 ft/s, with an average flow depth of 0.18 ft. The median riprap diameter was calculated to be 17.7 inches. This was rounded up to a median diameter of 18 inches for construction purposes. This agrees with the diameter initially assumed for calculating Manning's roughness coefficient, thus verifying the appropriateness of that assumed value.

Riprap gradation and the need for filter layers were determined based on the recommendations of Brown and Clyde (1989). The filter material used previously consisted of sandy gravel with a median particle diameter of 0.25 inch. Site observations indicate that a sufficient quantity of this material remains on site for use as a filter layer.

The calculations presented in Attachment B indicate that two filter layers will be required between the riprap layer and the underlying soil. The uppermost filter layer will consist of coarse gravel with a median particle diameter of 1.5 inches. The lower filter layer will consist of the previous filter material with a median particle diameter of 0.25 inch. Based on the recommendations of Brown and Clyde, the armoring materials will have the following approximate gradations:

Percent Passing	Ideal Size (in)			Desirable Size Range (in)		
	Riprap	Upper Filter	Lower Filter	Riprap	Upper Filter	Lower Filter
100	29	2.4	0.40	27-31	2.2-2.4	0.38-0.43
85	23	2.0	0.32	22-25	1.8-2.1	0.30-0.35
50	18	1.5	0.25	18-21	1.5-1.7	0.25-0.29
15	9	0.8	0.12	7-11	0.6-0.9	0.10-0.15

Consistent with the recommendations of Brown and Clyde (1989), each filter layer will be placed to a thickness of 4 to 8 inches. The resulting cross section of the lower portion of reclamation channel SD-6 is shown in Figure 1.

### 3.0 REPAIR PLAN

Only the lower of channel SD-6 will require repair. In accordance with the above calculations, the channel will be replaced as indicated on Figure 1. The basic plan for repair of the channel is as follows:

- Mobilize equipment and materials to the site and install sediment controls as necessary.
- Recover riprap and filter material that has accumulated at the downstream end of the channel for re-use as appropriate.
- Regrade the lower section of the damaged channel, as necessary, to fill eroded sections and achieve the required grades.
- Install the lower filter bedding ( $D_{50}=0.25$  inch) to a depth of 4 to 8 inches.
- Install the lower filter bedding ( $D_{50}=1.5$  inches) to a depth of 4 to 8 inches.
- Install  $D_{50} = 18$  inch riprap to a depth of 30 inches.
- Revegetate all areas disturbed by this project.

Riprap used in the channel repair will be durable, angular, hard, and free from seams and cracks. The riprap and filter materials will meet the gradations indicated in Section 2.0 of this plan.

Areas that are affected by equipment access will be gouged as necessary as the equipment departs from the site. This will loosen the topsoil and minimize the long-term potential for erosion of these areas. The affected areas will then be revegetated using the seed mix provided in Table 3-3 of the Mining and Reclamation Plan. Certification will be obtained from the seed supplier to ensure that the seed mix does not contain weed seed in excess of 0.5% of the aggregate weight of pure live seed.

Seeding will be accomplished via hydroseeding or broadcast seeding. If hydroseeding is used, the seed will be mixed with a small amount of wood fiber mulch, used as tracer, and water to form a slurry. If broadcast seeding is used, the seed will be broadcast by mechanical means, or by hand, such that the seed is uniformly distributed. Mulch will be applied as indicated in Section 3.5.5.3 of the Mining and Reclamation Plan. Bowie's goal is to complete all seeding this year prior to the onset of significant snowfall.

### 4.0 REFERENCES

Anderson, A.G., A.S. Paintal, and J.T. Davenport. 1970. Tentative Design Procedure for Riprap-Lined Channels. National Cooperative Highway Research Program Report 108. Highway Research Board, Division of Engineering, National Academy of Sciences. Washington, D.C.

Bowie Resource Partners, LLC  
Grand Junction, Colorado

Revised SD-6 Channel Repair Plan  
October 5, 2015

Brown, S.A. and E.S. Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. Federal Highway Administration, Office of Implementation. McLean, VA.

Searcy, J.K. 1967. Use of Riprap for Bank Protection. Hydraulic Engineering Circular No. 11. Federal Highway Administration, Hydraulics Branch, Bridge Division, Office of Engineering and Traffic Operations. Washington, D.C.

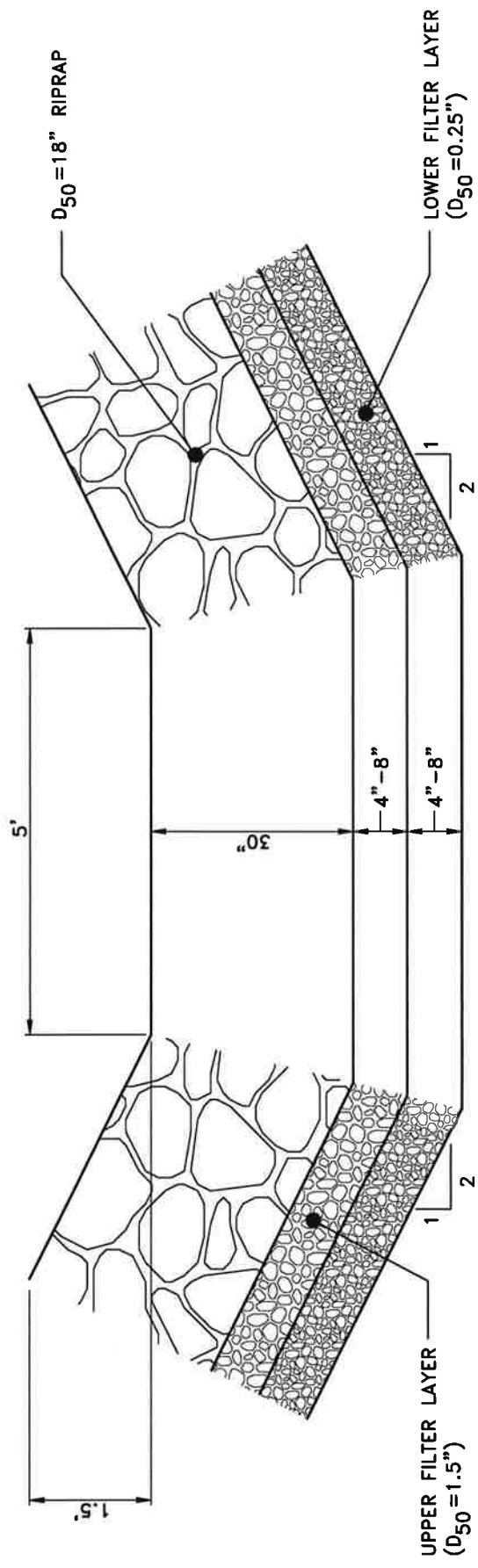


FIGURE 1. REPAIRED RECLAMATION CHANNEL SD-6 CROSS SECTION

Bowie Resource Partners, LLC  
Grand Junction, Colorado

Revised SD-6 Channel Repair Plan  
October 5, 2015

**ATTACHMENT A**

Photographs



Upper (mild slope) section of SD-6. Note lack of erosion.



Downstream view of eroded (steep slope) section of SD-6



Upstream view of eroded (steep slope) section of SD-6



Eroded material collected at the bottom of SD-6



Rock adjacent to downstream end of SD-6, potentially available for use as riprap



Rock and fine filter material at site entrance, potentially available for use in channel repair

Bowie Resource Partners, LLC  
Grand Junction, Colorado

Revised SD-6 Channel Repair Plan  
October 5, 2015

**ATTACHMENT B**

Design Calculations

# Redesign of SD-6 Lower Section Worksheet for Trapezoidal Channel

Project Description	
Worksheet	SD-6 Lower Sec
Flow Element	Trapezoidal Cha
Method	Manning's Formu
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.042
Slope	440000 ft/ft
Left Side Slope	0.50 V : H
Right Side Slope	0.50 V : H
Bottom Width	5.00 ft
Discharge	7.08 cfs

Results	
Depth	0.18 ft
Flow Area	1.0 ft <sup>2</sup>
Wetted Perim	5.82 ft
Top Width	5.73 ft
Critical Depth	0.38 ft
Critical Slope	0.038453 ft/ft
Velocity	7.18 ft/s
Velocity Head	0.80 ft
Specific Energ	0.99 ft
Froude Numb	3.05
Flow Type	Supercritical

**EARTHFAX ENGINEERING GROUP, LLC**  
**RIPRAP SIZING BASED ON HEC-11**

Project #: UC-1489-02

Site: Reclamation channel SD-6, lower section, Gordon Creek 2,7,8 Mine

Engineer: RB White

Bank angle = 2 :1 = 26.57 degrees = 0.464 radians  
Rpirap material angle of repose = 39 degrees = 0.681 radians

K1 = 0.704

Channel	Design Velocity (ft/s)	Flow Depth (ft)	Median Riprap Diameter		
			Calculated (ft)	Calculated (in)	Planned (in)
SD-6	7.18	0.18	1.478	17.7	18

Reference:

Brown, S.A. and E.S, Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. U.S. Department of Transportation, Federal Highway Administration. McLean, Virginia.

**EARTHFAX ENGINEERING GROUP, LLC**  
**RIPRAP FILTER CALCULATION**

Project #: UC-1489-02  
Site: Reclamation channel SD-6, lower section, Gordon Creek 2,7,8 Mine  
Engineer: RB White

Assumed median diameters (inches):

Riprap: 18  
Upper Fltr: 1.5  
Lower Fltr: 0.25 (i.e., old filter material)

Ideal calculated or measured gradations (inches):

Size Class	Riprap	Upper Filter	Lower Filter
D <sub>100</sub>	28.8	2.4	0.4
D <sub>85</sub>	23.4	1.95	0.325
D <sub>50</sub>	18	1.5	0.25
D <sub>15</sub>	9	0.75	0.125

Calculated gradations based on:

D<sub>100</sub> = 1.5 D<sub>50</sub> to 1.7 D<sub>50</sub>  
D<sub>85</sub> = 1.2 D<sub>50</sub> to 1.4 D<sub>50</sub>  
D<sub>50</sub> = 1.0 D<sub>50</sub> to 1.1 D<sub>50</sub>  
D<sub>15</sub> = 0.4 D<sub>50</sub> to 0.6 D<sub>50</sub>

Filter gradation criteria:

$D_{15}(\text{coarser layer})/D_{85}(\text{finer layer}) < 5$

$5 < D_{15}(\text{coarser layer})/D_{15}(\text{finer layer}) < 40$

Filter gradation check:

Layers Compared	D <sub>15</sub> (coarse)/D <sub>85</sub> (fine)	D <sub>15</sub> (coarse)/D <sub>15</sub> (fine)	OK?
Riprap vs. Upper	4.6	12.0	Yes
Upper vs. Lower	2.3	6.0	Yes
Criterion	< 5	5 - 40	

Reference:

Brown, S.A. and E.S. Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. Federal Highway Administration. McLean, VA.